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Lahontan Regional Water Quality Control Board

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Comments on Atlantic Richfield Company's Draft Focused Feasibility Study Revegetation Treatability Study Work Plan, Leviathan Mine Site, Alpine County, California

Thank you for the opportunity to comment on Atlantic Richfield Company's, March 31, 2016, Draft *Focused Feasibility Study Revegetation Treatability Study Work Plan* for the Leviathan Mine Site. The California Regional Water Quality Control Board, Lahontan Region (Water Board), staff has general comments followed by more specific comments. Additionally, Vic Claassen, PhD of University of California, Davis, has assisted the Water Board with reviewing the work plan. Water Board staff is requesting that Dr. Claassen's comments (enclosed) also be reviewed and addressed.

In general, there are many valuable components to this draft revegetation treatability study; however, there are a few major components that cause concern. Proposing the use of non-native species for revegetation is of primary concern. Water Board staff has consulted with and/or reviewed guidance documents from multiple federal and state agencies that either have jurisdiction or authority related to the use of non-native species, including United States Forest Service, United States Environmental Protection Agency, Bureau of Land Management-California State Office, Natural Resources Conservation Service, California Department of Fish and Wildlife (CDFW), and California Department of Conservation–Office of Mine Reclamation. These agencies have policies, regulations, and/or guidelines that, at a minimum, promote the use of native species and discourage the use of non-native species. The CDFW is one such agency. CDFW staff focus on using native vegetation for habit restoration projects and other uses is guided, in part, by two California Fish and Game Commission policies; *California Policy for Native Plants* and *Introduction of Non-native Species*. Both policies are available at: http://www.fgc.ca.gov/policy/p4misc.aspx. The second policy, above, does allow for the introduction of some exotic species, but, only after meeting specific criteria and only after being approved by the California Fish and Game Commission. Failing to follow the applicable policies and procedures regarding use of non-native species in California, places the Water Board at risk of future enforcement actions. Additionally, Water Board staff is concerned about potential liability related to introducing or spreading non-native species, some of which can be very invasive and threaten or even replace native vegetation populations in the surrounding area.

In addition to the Water Board's concerns regarding regulatory requirements, Dr. Claassen's comments provide scientific support for selecting native species over non-native species. Dr. Claassen's comments regarding native species at the Leviathan Mine site are based, in part, upon his vegetation studies at Leviathan Mine under contract to the Water Board. His comments provide scientific support that compliments the regulatory framework the Water Board is subject to.

For the reasons stated above, the Water Board cannot support the use of non-native species as proposed in the treatability study nor for revegetation work at the Leviathan Mine site. Water Board staff recommends removing the use of non-native species from the treatability study and from future consideration.

Specific Comments

1. Page 4, Section 3.1, third paragraph, first sentence – As part of the Pollution Abatement Project, ponds were constructed to store Acid Mine Drainage, not runoff. The same comment is applicable for Appendix A, page 3. Please revise sentences to remove "and runoff."

2. Page 6, Section 3.1, last paragraph – The circa 2000 Delta Slope Plot location was excavated, regraded, amended with lime and compost, and seeded during the Delta Slope stabilization efforts conducted in 2005. The Delta Slope Plot summarized by Claassen in 2015 is for work completed after the 2005 Delta Slope stabilization efforts. Appendix A, Section 2.5, first paragraph provides a more accurate summary of the work that is being summarized in the above-referenced paragraph. Please revise to improve clarity.

3. Page 7, Section 3.2.1, second paragraph – This paragraph indicates the Delta Slope Slide is still prone to debris flows. The Water Board implemented a project to stabilize the Delta Slope Slide in 2005. Please revise this paragraph to reflect current conditions.

4. Page 7, Section 3.2.1, last paragraph, second sentence – Some of the overburden slopes remain at very steep angles and prevent a robust revegetation program due to their instability. The potential for regrading slopes greater than 30 percent to facilitate future robust revegetation efforts is expected to be evaluated as a component of the Feasibility Study and should be stated in this section for additional clarification.

5. Page 10, Section 3.2.3, second and third paragraph – The statements that "Surface topography will play a role in the feasibility and effectiveness of revegetation at the site.", and "The potential for revegetation as a function of surface topography will be evaluated as part of the FS.", should be revised as the surface topography can be modified to create favorable conditions for revegetation by regrading portions of the mine site.

6. Page 10, Section 3.2.3, third paragraph – As shown in Figure 5, a significant portion of the mine site has slopes greater than 30 percent, which may require regrading in the future. The regrading of slopes greater than 30 percent is expected to be evaluated as a component of the Feasibility Study and should be stated in this section for additional clarification.

7. Page 10, Section 3.2.3, third paragraph – As part of this study, three revegetation test plots are proposed; however, only one will be located on a moderate slope, while the other two are on moderately flat areas. Due to the topography of the site, there is a need to demonstrate effective techniques for incorporating soil amendment to a depth of approximately three (3) feet for large-scale revegetation projects in the future. Two of the three test plots should be constructed on moderate slopes up to approximately 30 percent (about 3 horizontal to 1 vertical).

8. Page 13, Section 3.2.6, third paragraph – The stated conclusion does not appear to take into consideration the statements regarding the potential for aluminum-related phytotoxicity provided in the first paragraph of this section.

9. Page 19, Section 5.1.2, bulleted section and third paragraph – Since the site topography will likely require revegetation on many sloped areas, Water Board staff recommends Revegetation Plot 2 be constructed on a slope and ideally avoid areas with conifers, if possible, as these areas may have been part of past revegetation efforts. Additionally, Water Board staff can assist with identifying a suitable location for the Revegetation Plot 3 in the Leviathan Creek Study Area.

10. Page 20, Section 5.1.3, first sentence – How have the revegetation plot locations been selected on the basis of soil texture (coarse and fine)?

11. Page 20, Section 5.1.3, second sentence – The amendment depth is specified as a range from 2-3 feet below ground surface (bgs). The amendment depth should be targeted at 3 feet bgs to ensure plants can access the moisture that is held in the deeper substrate. Page 36, footnote 5 seems to imply that the 3-foot bgs sample will be below the amended substrate. Water Board staff recommends specifying the amendment depth to be 3 feet bgs and to have a deeper sampling depth identified for analysis.

12. Page 25, Section 5.1.6, second paragraph – Plant selection guidance from the Surface Mining Control and Reclamation Act text cited directs that "the establishment on the mined areas, and all other lands affected a diverse, effective and permanent vegetative cover of the same seasonal variety native to the area of land…" The text preceding this citation includes the provision that "introduced species may be used in the revegetation process where desirable and necessary to achieve the approved post mining land use plan." This provision would apply, for example, if the land use plan was for this area to be a golf course, where it would be necessary to use non-native plant species to achieve such a land use. However, this is not the case at Leviathan Mine. Water Board staff interpretation of this guidance requires the use of native vegetation for revegetation projects at the Leviathan Mine site.

13. Page 25, Section 5.1.6, fourth paragraph and footnote 3 – Planting Mix B appears to include plant species that are not native to this area, and raises concerns regarding their use in this treatability study. State policies and guidance, at a minimum, promote the use of native species and discourage use of non-native species for restoration projects. While the final end use of Leviathan Mine is subject to the CERCLA process, it is anticipated that the long term goal will be to attempt to return the land to conditions similar to surrounding lands, which would include vegetation native to the area.

    The Leviathan Mine Superfund site is regulated under CERCLA, and as such, the USEPA is required to consider the substantive state policies, regulations, and guidance documents regarding the use of non-native species. Water Board staff also has concerns regarding liability related to introducing or spreading non-native invasive species. Water Board staff recommends using only native plant species in this treatability study. An added benefit to eliminating Mix B would be to allow for more replicates using Mix A, thereby, reducing the number of variables within each test plot.

14. Page 31, Section 5.3.1.2, first paragraph – As part of the Water Board's weed abatement program at Leviathan Mine, all equipment and machinery used on the Leviathan Mine site is required to be cleaned and inspected prior to use on site. This is in addition to having certified weed free seed mixtures, amendments, mulch/compost, and other imported materials used on site. Please include language in this section to address this important component.

15. Page 35 and 36, Sections 6.3.1 and 6.3.2 –Water Board staff recommends submitting discrete soil samples, as opposed to the composite samples proposed. Discrete samples would allow for an evaluation of before and after comparisons at the same sample location. The sampling approach should also allow for evaluation of lime requirements of substrates at depth shortly after being amended and again after two years.

16. Page 38, Section 6.3.3, third paragraph, third sentence – It is unclear how these sample locations will be determined, and is questionable if such differentiation of substrate soil sizes (coarse, medium, or fine grained) for sampling is possible.

17. Page 43, Section 6.6.1, bulleted list – This bulleted list includes parameters to be observed and noted on field sheets. What are the ranges of cover to be given the values of high, moderate, low, or minimal? How will herbivory and water availability be determined?

If you have any questions regarding these comments, please contact Hannah Schembri, Water Resource Control Engineer, at hannah.schembri@waterboards.ca.gov or (530) 542-5423, or me at douglas.carey@waterboards.ca.gov or (530) 542-5468.

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Enclosure: Dr. Vic Claassen, PhD, University of California, Davis - *Comments on Atlantic Richfield Company's, Draft Focused Feasibility Study Revegetation Treatability Study Work Plan, Leviathan Mine Site, Alpine County, California*

Comments on Atlantic Richfield Company's Draft Focused Feasibility Study Revegetation Treatability Study Work Plan, Leviathan Mine Site, Alpine County, California

Vic Claassen, PhD
Soils and Revegetation
UC Davis
May 10, 2016

1) pg 8, Section 3.2.2 Climate:
Please include a table summarizing average historical monthly precipitation and evaporation. This general water balance would illustrate the influence of the Mediterranean climate on plant growth and soil moisture dynamics, showing the gap between winter precipitation and summer evaporation potential. This illustrates the need for adequate moisture infiltration and adequate moisture reserves for growth through the summer and provides the rationale for regenerating adequate rooting depth and rooting access through neutralization.

2) pg 9 and 10, Section 3.2.3 Site Topography:
Less steep slopes are desirable and more easily treatable, but space restrictions suggest that steeper slopes may be needed in some areas, especially in the Leviathan Creek corridor. Will the Revegetation Treatability Study (RTS) develop constructible stabilization methods for steep slopes?

3) pg 12, Section 3.2.5 Physical Properties of Mine Waste, line 4 of the second full paragraph:
The sentence reads "Mine waste properties need to be modified..." does this refer to 'texture' in the previous sentence? Does the study plan involve mixing of substrate particle sizes to adjust texture?

4) pg 13, Section 3.2.6 Chemical Properties of Mine Waste:
Regarding the seven bulleted indicator elements for phytotoxicity:
Any evaluation of chemical toxicity for plant growth should be based on agronomic extracts for plant-available levels and the field pH levels, not the total metal content. Total metal contents do not relate to levels that are taken up by plant roots. Please provide a reference for the target levels used for the finding in the last line that states "total soil concentrations that might cause plant phytotoxicity do not appear to be present."

5) pg 14, Section 3.2.6 Chemical Properties of Mine Waste, first full paragraph, line 3:
Edit to read "...limestone or other sources of alkalinity to neutralize..." also, scan the document and replace the word 'limestone' with a more generic 'lime' or 'alkalinity' in many of the cases where appropriate.

6) pg 14, Section 3.2.7 Hydrology:
Please provide general average monthly water balance for precipitation and evaporation here, if it is not included in the introduction Section 3.2.2, as in Comment # 1.

7) pg 17, Section 4.0 Data Quality Objectives:
Problem Statement 1:
The Study Questions should be refined. Only Question 1-1 lists a range of plant species that will be evaluated for suitability. The remaining questions only test one selected treatment for each variable. So the Study Question should be phrased: 'Does this one selected treatment work over the project revegetation establishment period?' Without testing multiple treatments, one cannot say that different types of amendments, application rates, application methods, or different rooting depths are being tested.

Problem Statement 2:
If the ability of vegetation to mitigate deep percolation is to be evaluated as a long-term remedy, what is the process of judging a successful outcome or potential failure scenarios like high rainfall events? The Study Question appears to be mainly a comparison of the vegetated /non-vegetated plots. Is there any evaluation of other types of weather conditions than may occur during the study? Hydrologic

parameters are generated but what broader modelling effort is planned? Sections 5.3.2.3, 5.3.2.4, 5.4, and 6.4 extensively describe installation and operation, but less information is provided on a framework for evaluating success through a range of scenarios that the fully remediated mine site can be expected to withstand.

8) pg 19, Section 5.1.2 Test Plot Location Selection, last paragraph:
The current Hydrology plot locations are located in an area of the mine that appears to have a different substrate than the majority of the Mine Waste area in the ACSA (Figure 9). Information from a hydrologic characterization would be more applicable if plots were re-located within representative areas of the ACSA overburden or mine waste such as the large expanses of light colored substrates.

9) pg 20, Sect 5.1.3 Revegetation Test Plot Design:
Suggest to replace the Accession Seed Plots (Mix B) with Native Seed (Mix A) and increase the replication number of revegetation plots. Plot replication should be increased to at least 4 if any statistical evaluation is to be done.

10) pg 21, Sect 5.1.4 Hydrology Test Plot Design, first paragraph:
It is generally true that native species grow and establish slowly at first, becoming robust after several years. An exception is the native grass Great Basin Wild Rye (*Leymus cinereus*). Especially if planted as plugs, this grass will rapidly establish and develop evapotranspiration by the second year. In addition it can be established as a uniform cover. Woody plants, in addition to being slower to establish, are difficult to establish as a uniform stand. It seems appropriate that, given the short duration of the RTS, either existing stands need to be used or use a rapid grower like Great Basin Wild Rye.

11) pg 21, Sect 5.1.4 Hydrology Test Plot Design:
Please include a general average historical water balance showing average and extreme (wet or dry) seasonal rain or snow melt scenarios and evaporation potential to contrast with the data gathered during the field portion of the study (as in Comment # 1 and 7). Page 8 reports that approximately 5 years of meteorological monitoring have occurred at the site. What do these existing data suggest about the expected wetness or desiccation of the near-surface substrates in typical or non-typical years? This scoping information would be useful for design of the RTS field plots.

12) pg 21, Section 5.1.4 Hydrology Test Plot Design:
The 'barren' hydrology plots should be re-designed and not compare barren locations with existing vegetation. Areas that are currently barren of vegetation likely have some type of growth-limiting substrate condition or else they would have developed some type of vegetative cover in the last few decades. Verifying that the substrates are hydrologically comparable is difficult (timing of moisture, differences in matric tension, transitory flows from up-slope, substrate depth or rootability). A more convincing comparison for the effect of plant transpiration on water fluxes would be to select a larger, uniformly vegetated area (representing years of uniform plant response to moisture across the plot area) that is divided in half. The vegetation can be removed for the non-vegetated ('barren') treatment by removing top growth by herbicide, heat treatment, or stem cutting.

This type of paired vegetated / non-vegetated (or de-vegetated or 'barren') plot would test vegetation transpiration effects alone, without the risk of confounding effects of different substrates. Several published examples of removal of top growth and effects on resultant soil moisture measurement (as proposed in the RTS) are available. Stem flow instruments are also available that estimate water uptake. Instrumentation function should be calibrated and verified at the start of the trial.

13) pg 22, Section 5.1.5.1 Surface Treatment:
Recommend to include bulk density testing (within and below treatment horizons) after incorporation treatments.

14) pg 22, Section 5.1.5.2 Liming:
What is the numerical target for neutralization? What does 'circumneutral' (pg 14) mean for a site that is variable in pH and reacidification potential, such as local areas with gray pyrite, or local acid spots?

15) pg 23, Section 5.1.5.2 Liming, third full paragraph, last line:
After the ABA evaluation is done and a lime rate selected, how will the accuracy of the estimation method and treatment level be evaluated? The ABA acid neutralization estimation tests are stated to include sulfur speciation but also acid generation potential and acid neutralization potential. What are the various sources of acid generation that are accounted for besides those associated with sulfur oxidation? Is the 25 % over-application of lime a response to results from other ABA estimates versus field test results? In order to speed up any potential reacidification processes before the end of the project, recommend to check the ABA estimates with an empirical pH monitoring incubation of moist, room temperature mixtures of substrate and lime. By maintaining these substrates in moist and warm conditions, acidification reactions will proceed more quickly and will allow for the ABA estimates to be evaluated.

16) pg 23 and 24, Sect 5.1.5.3 Fertilizer:
Rephrase or clarify such that the 200 - 300 kg N/ha is specified as 'total' applied fertilizer nitrogen whereas the plant-available fertilizer would not exceed 80 kg N/ha per year, or some other appropriate referenced value.

17) pg 24, Sect 5.1.5.4 Organic Matter:
Plant-available nitrogen from compost can be included in the per-year nitrogen target. Total nitrogen in the compost application should not exceed 1000 kg total N/ha.

18) pg 24, Section 5.1.6 Plant Selection and Development of Planting Strategies:
Rationale for specification of native species:
In spite of occasional summer rain showers, all soils in the area around the mine are classified by the NRCS as having a 'xeric' moisture regime, meaning the soil is dry in the rooting section for a month or longer in the hot, late summer season during 6 out of 10 years. For this reason, plant species are needed that are adapted to this xeric or Mediterranean moisture regime. Plant species from 'arid' areas also can have low rainfall amounts but rain still typically occurs during summer. Rainfall totals are not relevant for comparison between 'dry' locations throughout the West and the Leviathan Mine site because most of the precipitation on site falls during the cold, winter season and is lost before a plant can use it. The point in using native species is not to regenerate a native habitat since this site is now a remediated mine not a natural area. Rather, the point is to use native species that can tolerate the existing environmental conditions, namely winter moisture, extensive summer drought and a very short growing season that depends on plant cueing and probably winter root growth in the often non-frozen soils. Native species are expected to be more likely than most accessions to survive the whole range of environmental and biological conditions such as climate tolerance, seasonal cueing, disease resistance and herbivory patterns.

Also, consider that most wildlands plants will spend a year in a low growth form as they grow deep roots (to optimize below-ground competitiveness and survival) and only in the second year start more rapid top growth (to develop above-ground competitiveness). Weeds do the opposite. Therefore, short term comparisons of plant growth between species will often select for weedy, short-lived plant types.

19) pg 25, Section 5.1.6 Plant Selection and Development of Planting Strategies, second full paragraph: Insert at the end of the paragraph "at similar elevations as the mine site". The sentence should read "Seed will be collected from the northeastern Sierra region or from the Great Basin at similar elevations as the mine site."

20) pg 27, Section 5.2.2 Baseline sampling, second bullet point:
Describe the test method for weak acid-extractable metals as a plant-available, agronomic parameter, especially for acid mine lands and/or lime-amended substrates. Consider diethylenetriaminepentaacetic acid (DTPA) or ammonium acetate extracts and associated interpretation thresholds for plant-available micronutrient levels.

21) pg 27, Section 5.2.3 Amendment Incorporation:
Confirm bulk density within and below treatment depths after incorporation. Alternatively, for steep areas, amendment by 1 foot lifts can be done with conventional equipment during slope construction.

22) pg 27, Section 5.2.4 Post-Amendment Evaluation:
Replace pH indicator spray with pH measurement using equilibrated water samples and a portable pH probe with an appropriate electrode for these substrate conditions. A gridded data set will be a helpful analysis to evaluate the different lime incorporation methods tested.

23) pg 28, Section 5.2.5 Soil Moisture Monitoring:
Recommend relocating the Hydrology test plots on more representative areas of the ACSA overburden materials.

24) pg 29, Section 5.2.6 Seeding:
Recommend to increase the number of seeded plots for statistical validity. Confirm that the rhizobial inoculants used are from the correct cross-inoculation group for the planted species.

Inclusion of mycorrhizal inocula on seed coatings is not recommended. The more extreme the substrate conditions, the more likely it is that local, site-adapted mycorrhizal fungi are better suited for local growth conditions, not commercial, green-house produced agricultural-oriented inocula as used in pelletized coatings. Suggest to make a collection of some live soil inoculum from existing areas of 'disturbed-but-revegetated' substrate that are similar to the test plot substrate. This should be applied to the plots before seeding and immediately tilled (within 10-15 minutes and not when surface temperatures are high). The inoculum should not dry on the surface. Seeding can follow as schedule allows.

If seeded ceanothus, mountain mahogany, or antelope bitterbrush get added to the seed mix, they need an additional inoculum. They make their own nitrogen fertilizer using soil microbes available only from local site-collected accessions. As before these should be surface applied and immediately tilled in before seeding. Rates are estimated to be approximately two cups of live soil spread over a square yard.

25) pg 31, Section 5.3.1.1 Irrigation:
Good, recommend adding after last line "A single wet-up of the rooting profile in late spring may be considered if substrate moisture is not recharged by natural precipitation."

26) pg 31, Section 5.3.1.2 Weed Control:
Good. If dense stands of an invasive grass colonizes one or more of the plots consider hand removal of seed heads before shatter to help prevent second year plot growth from being swamped. True, these grasses are ubiquitous in the West, but these freshly amended plots may generate a strong second year response from invasive species if they get going the first year. This could add another artifact to the plant growth data being collected.

27) pg 31, Section 5.3.1.3 Erosion Control:
Good. A monthly water balance, along with daily rainfall maximums, can be used to compare measured infiltration rates and depths in contrast to the rainfall inputs measured or expected.

28) pg 32, Section 5.3.2.1 Vegetation:
How will stands of small grass seedlings be counted? Point-intercept transects often do not count thin, vertical leaves. Cover from a few broad leaf seedlings will exceed hundreds of grass seedlings. Suggest to count density of grass seedlings within the belt transect.

29) pg 32, Sect 5.3.2.2 Soil chemistry:
Suggest to do a parallel, room-temperature incubation with lime-amended, well mixed materials that goes through winter to speed up and observe re-acidification processes, if any.

30) pg 33, Sect 5.3.2.3 Soil Moisture:
Concerns about the layout of the hydrology test plot and instrumentation function are discussed in Section 6.0.

31) pg 33, Sect 5.3.2.4 Precipitation and Evaporation:
How is snow fall vs snow melt vs sublimation quantified? What evapotranspiration data is available for snow-free periods during the winter? How will this de-water the substrate prior to the wetter spring season?

32) pg 36, Sect 6.3.2 Revegetation Test Plots: Post-Amendment and Final:
Recommend to verify bulk density levels of treated and non-treated areas. Test substrate pH with water and pH electrode or send samples to the lab rather than using a pH test strip or indicator spray. How is incorporation 'effectiveness' proposed to be evaluated? Additionally how will decompaction of the substrate be evaluated?

33) pg 38, Sect 6.3.3 Hydrology Test Plots: Baseline, second full paragraph:
What is the back-up plan if the 'three discrete, intact soil cores' cannot be collected due to high rock content? How are hydrologic modelling parameters determined? What are the products of hydrologic modelling and how will they be used?

34) pg 39, Sect 6.4.1.2 Soil Moisture Content and Temperature Sensors, second paragraph:
What is the volume of moisture detection around the sensor arms of these probes? Does the probe body sense moisture (and need to be buried) or just the probe arms? What are the results of rocks within this detection area? One possible method would be to use a thin ice pick or probe to check for

rocks in the moisture detection volume of each probe. Press and re-firm substrate to ambient density to remove air gaps resulting from physical insertion of the probe.

When backfilling the access hole, bury a loop in the probe cord so that surface moisture does not flow downward along the substrate - cable surface.

How will the indicated substrate moisture reported by the probe be calibrated or validated to the actual substrate moisture content? Suggest sampling from the installation hole to provide field check on soil moisture probe readings.

35) pg 40, Section 6.4.2.2 Deep Percolation Flux Gauges:
Good attention and description of backfilling by horizon and representative packing of Flux Gauge installation bore holes. What is the plan if the substrate is too rocky to bore without extensive disturbance from displacement of larger rocks?

36) pg 40, Section 6.4.2.2 Deep Percolation Flux Gauges:
How will the performance of the Flux Gauge be validated? Some substrate textures and densities do not function well with the Drain Gauge due to convergence or divergence errors. The Decagon G3 Manual indicates a range of collection efficiencies (other than in sand substrates) depending on substrate moisture. Are other wick densities or Divergence Control Tubes available? Placement of a soil matric sensor near the top of the gauge would help interpret matric potential for flux divergence / convergence errors. A soil moisture release curve of the substrates of potential site locations prior to installation would help develop an effective installation.
Reference: Drain Gauge G3 Manual pg 10 Fig 2 (pg 361 of 802 of RTS document).

37) pg 40, Section 6.4.2.3 Soil Moisture Content and Temperature Sensors:
Temperature sensors are a good idea for detecting ground freezing at depth. Frozen ground will change water flow patterns in ways not detectable by soil texture analysis alone. How will moisture inputs from accumulated snow pack and snow melt be accounted for through the winter? How is the input from a sudden snow melt or rain-on-snow event measured?

38) pg 41, Section 6.4.2.3 Soil Moisture Content and Temperature Sensors, first full paragraph:
The depths listed in Section 6.4.1.2 are shallower and workable. In this section, the depths are much deeper and potentially inaccessible from the surface. How will probes be installed in the wall of a six inch diameter borehole at depths of 3, 4, 5, 7.5 and 10 feet?

39) pg 42, Section 6.4.4 Operation and Maintenance, second paragraph:
Regarding Factory Calibration: The 5TM manual pg 7 (pg 167 of 802 of RTS document) refers to its moisture detection performance in a 'normal mineral soil'. Verify that probe function is accurate and well calibrated for these mined substrates compared to a 'normal soil'. What are your acceptable standards for error?

40) pg 42, Section 6.5 Meteorological Monitoring Station:
Same as Comment # 31 for Section 5.3.2.4:
How is snow sublimation estimated? A heated snow / rain gauge measures the inputs; what about evaporative losses through the winter? Is all snow fall estimated to become liquid input that flows into the substrate? What water budget analysis is expected from these precipitation and substrate moisture data?

41) pg 43, Section 6.6 Vegetation Monitoring:
Suggest to mark out established access paths within the plots for walking to the instruments or plot interiors to limit chronic monitoring disturbance.

42) pg 44 Section 6.6.2 Quantitative Data Collection:
Same as Comment # 28 for Section 5.3.2.1:
The planted species are predominantly grasses. Point-intercept can give low values with small, vertical leaves. Are there other methods to count seedling forms that may be dense but have very little vertical projection that is counted by point intercept? Can density be added to the belt transect to provide a count of individuals? In the third to last line of pg 44, does 'species count' mean # of individuals of each species? This approach would better represent young grass seedlings.